

AbstractID: 1410 Title: On the discrepancies between Monte Carlo-based dose calculations and measurements in the buildup region of megavoltage Varian photon beams

Monte Carlo-based dose calculations are generally in good agreement with measurements for megavoltage photon beams. The BEAM/DOSXYZ code package is used in most cases. However, 15% difference was observed between measurements and BEAM-based dose calculations in the buildup region for the Varian-21EX 18 MV beam (40 cm × 40 cm). The GEPTS Monte Carlo system is used to investigate this case. Phase space data files with up to 60 million particles are generated at the isocenter. Electron splitting is used to sample accurately electron contamination. Since similar discrepancies are observed in the buildup region when using the exact manufacturer specifications of the beam, different beam parameters were varied in order to achieve a better agreement with measurements. This includes the energy of primary electrons (average value and broadening), the beam radius and the beam solid angle. All these attempts failed. Varying the composition and density of the target, flattening filter and jaws within reasonable uncertainty limits was also unsuccessful. Finally, a better agreement with measurements was achieved by shifting the position of the target and increasing the radii of the primary collimator. Using the modified beam model, the differences in the buildup region was reduced to less than 1% at 1 cm depth. Lateral dose profiles agree with measurements within 2%. Full simulation of the ionization chamber is performed to draw a direct comparison with the raw ionization chamber readings. The measured and calculated ionization chamber responses are within 1% down to 4 mm distance from the phantom surface.